The MSD PI Guide to Environment, Health and Safety

A Culture &
Seven Elements of a Safe Lab

5.27.09

SCHEDULE OF ACTIVITIES

A Number of EH&S activities should be repeated throughout the year.

Activity	Schedule
Group safety meeting/Check group assignments	Monthly
Inspect Labs	Three times per year
Review required "fixes" in CATS (p. 5)	Three times per year
Update JHA	Annually when due
Confirm training of staff/students–**report provided to PI**	Monthly
Update AHDs and other authorizations	Annually when due
Inspect SAAs	Quarterly
Empty SAAs	Twice yearly
Review chemical inventory	Twice yearly
Test peroxidizable solvents	Annually

Abbreviations:

AHD: Activity Hazard Document
CATS: Corrective Action Tracking System
EH&S: Environment, Health & Safety
JHA: Job Hazards Analysis
LOTO: Lock-out-Tag-out
PI: Principal Investigator
PPE: Personal Protection Equipment
SAA: Satellite Accumulation Area

Facilities/EH&S Staff–Call for Expert Advice and Assistance

Title	Person	Phone #	email
Rick Kelly	Facility/EH&S Manager	x4088, 457-8452	RJKelly@lbl.gov
Paul Johnson	EH&S Technician	x5810, 206-0432	PMJohnson@lbl.gov
Susan Waters	Facility/EH&S Administrator	X5690	SLWaters@lbl.gov
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Howard Hansen	Waste Generator Assistant	x5867	HLHansen@lbl.gov
Ken Barat	Laser Safety Officer	495-2544	KBarat@lbl.gov
Gil Torres	Building Manager 62, 66, 67	x5395, 289-5137	GJTorres@lbl.gov
Gil Torres	*Acting* Building 2 Manager	x5395, 289-5137	GJTorres@lbl.gov
John Turner	Building 72 Manager	x5700	JHTurner@lbl.gov
After hours nonemergency x6999			
Emergency x7911			

To the MSD PI*:

Good EH&S practice in your laboratory is based upon: the right ATTITUDE and the right APPROACH.

1) The Right Attitude – The Commitment to Safety

An effective EH&S program arises from a commitment to safety. Your labs will remain safe only if you and the members of your group believe in the importance of safety and regard it as an integral part of all research activities.

While each individual researcher is responsible for his/her own safety and must look after the safety of his or her colleagues – in the lab, office, on LBNL grounds (e.g. bicycle safety) – you as PI are responsible for the safety of all members of your group. It is critically important that you create an environment in your lab that encourages staff, students and postdocs to ask questions if they are unsure of policies and procedures involving safety.

This responsibility is assigned not to place blame for errors or accidents, but rather to serve as a call for leadership, and to take advantage of your experience and knowledge of good safety practices.

2) The Right Approach – Integrated Safety Management (ISM)

ISM is the approach by which all work and activities are conducted at Lawrence Berkeley National Lab. Your facilitation of ISM can be accomplished by the following:

7 Basic Elements of Good EH&S Practice:

1. Be a safety leader – show your commitment, assign responsibilities, talk with your group
2. Inspect your laboratories –follow through with fixes
3. Identify, mitigate, and train staff to safely deal with lab and office hazards
4. Authorize work
5. Manage chemical use and storage
6. Manage waste
7. React correctly if something goes wrong

This booklet is designed to provide you with a concise guide to the proper management of safety in your lab. We recognize that it is impossible to prevent others from making mistakes, but by implementing the actions described here, you are doing all we can ask of you.

* MSD PIs are those scientists who, under authority granted by the Division Director, manage the scientific and operational aspects of a research project, and direct the scientific activities of another researcher in that project. PIs are responsible for all EH&S activities in their groups and labs. The LBNL term "work lead" is usually synonymous with PI in this context. In cases where the PI cannot monitor the labs regularly, a subordinate "area lead" can be appointed to fulfill that requirement.

SEVEN ELEMENTS OF A SAFE LAB

Details for each are outlined on the following pages

A thorough view of safety must be integrated into all aspects of research.

1. Be a Safety Leader – Talk About Safety With Your Research Group

Your labs will remain safe only if you and the members of your group believe in the importance of safety and regard it as an integral part of all research activities.

Establish a culture in your group that values safety. Discuss safety with each new group member when s/he arrives. Routinely discuss safety issues with staff, students and visitors. Review topics raised at Division Safety Committee meetings at your next group meeting. Show that you regard this as important.

The most important lesson to impart is that each researcher must take responsibility for his/her own safety. Each must also feel responsible for the safety of his or her colleagues. You, the PI, of course, remain responsible for the safety of all of the members of your group.

Researchers must, at every step in the experimental process, think about the EH&S implications. Identify hazards, take the appropriate steps to minimize risk and prepare for the unexpected. This is the premise of of ISM: Integrated Safety Management. It is not a chore to be gotten out of the way; it is part of the research process.

Also of importance is the issue of fatigue. Students, in particular, work long hours and must be reminded that fatigue can result in sloppy thinking and actions—both in the science and in the safe performance of the science. Encourage researchers not to work alone if possible and to stop work when fatigued.

Remind members of your group that users and vendors must also rigorously follow LBNL safety guidelines and that they must be certified by Rick Kelly before they start work.

At least once a year Rick Kelly, the MSD EH&S Manager, will meet with each research group to review safety issues and describe safety initiatives in the Division and lab.

Assign tasks to staff, senior students or postdocs, along with a junior colleague assistant who will step in when the senior member leaves. Key assignments include: SAA manager, chemical inventory coordinator, safety committee member, group safety coordinator, crane manager. Division and Lab EH&S professionals and administrators are here to advise and help in this, minimizing the burden on your time.

Safety Minute: Each student or postdoc who presents a talk at a group meeting should begin with a discussion of a safety-related item of interest, for example, a personal experience.

2. Laboratory Inspection Checklist

(Significant deficiencies that cannot be addressed immediately should be entered in the "CATS" system by Paul Johnson.)

copies at: http://www.lbl.gov/msd/msd_safety/communication.html

Category	Issue	Y/N/ NA	Entered CATS	Closed
Chemicals	Liquids stored in secondary containment tray, properly segregated			
	Manufacturer's containers/squeeze bottles labeled with name/hazard			
	All containers have proper identification (no unlabeled containers)			
	Commercial chemicals inventoried, including, gas cylinders			
	Eyewash/shower available where corrosives/irritants used			
	Calcium gluconate available for HF first aid, if used			
	Chemicals used in hood if vapors exposed, dust possible			
	Refrigerators used correctly for chemicals (flammables only in designated refrigerators, secondary containment, segregation)			
	Legacy chemicals not accumulating in lab			
	Gas cylinders secured, capped (if not in use), inventoried, labeled			
	Peroxidizable chemicals labeled, tested within 12 months, prop. stored			
Waste	A manager and backup assigned to each SAA			
	SAA posted, sign is filled out and current			
	All containers of waste have waste labels completely filled out			
	All waste containers are located in SAA, not elsewhere in lab			
	No non-waste containers are present in the SAA			
	Waste in SAA not more than 6 months			
	For combined waste, accumulation log kept accurately			
Formal Authorization	AHD signed and current for 1) Use of hazardous compressed gases 2) Use of >400 cubic feet of flammable gas 3) Class 3b or 4 lasers 4) Oxygen deficiency potential 5) Unusually hazardous operations, 6) Pyrophorics 7) Energized electrical work			
	Other authorizations (biological, human subject, radiation, vertebrate animal) in place and current			
	Comply with all conditions of formal authorization			
Housekeeping	Aisles and walkways clear, no tripping hazards			
	Minimum 28" clearance to exits			
	Benches, shelves, floor and hoods tidy, unused items stored safely			
Electrical	Sufficient electrical outlets to minimize use of extension cords			
	Cords, plugs in good condition			
	Energized electrical equipment closed or guarded			
Safety Equipment	Fume hoods working properly (100-120 fpm), sash operable, not overly cluttered, not in alarm mode. Hood is inspected within past 24 months			
	Eyewash/shower labeled as inspected within 90 days, not blocked			
	Large/heavy equipment seismically secured (refrigerators, shelves, storage cabinets, laser tables, 160 L Dewar's, electrical racks, etc)			
	Alarms and interlocks are calibrated/tested within 6 months			
Protective Equipment	Appropriate gloves are available where chemicals are in use			
	Safety glasses or goggles used where there may be eye hazards			
	Eye protection and cryogen gloves available, in good shape for use of LN			
	PPE in good condition, stored to prevent damage/contamination			

Category	Issue	Y/N/ NA	Entered CATS	Closed
Ergonomics	Significant lifting, twisting, bolt turning, computer use or other ergonomic hazards are evaluated			
Mechanical	Rotating parts, robots, mechanical equipment are guarded			
Signs	Required sign(s) present, accurate and visible (exit, eyewash, chemical storage, hazard communication)			
New Work	New work has been evaluated by PI and authorized			
Eye Washes	Inspected ≤90 days			

Additional Questions Used Where Applicable		Y/N/ NA	Entered CATS	Closed
Lasers	All entrance doors posted with laser sign identifying wavelengths			
(3b and 4)	Protective laser eyewear is available before entering the NHZ			
	All users are listed on the laser AHD and understand how to use laser			
	Interlocks (class 4) are present, operational and tested within 6 months			
	Bypass barrier is present and effective			
	Required (or usual) beam enclosures are present and installed			
	Tabletop housekeeping is good			
	Vertical beams are labeled			
	All lasers are in inventory and listed in the AHD			
X-Ray Mach.	X-ray use authorization is current, in x-ray log book			
	All users are listed on authorized user list posted on the machine			
	X-ray monitor (where applicable) is working			
	Card key access system is in use and functioning normally			
	X-ray indicator lights are working properly			
Biosafety	All work is described in a biological use registration			
	Biohazardous work is approved in a biological use authorization			
	Door is posted to indicate presence of biohazardous materials			
	Biosafety cabinet (if present) has been certified within 12 months			
	Biohazardous waste is properly stored and labeled			
	All containers with biohazardous materials are labeled			
Glove box	Glove box has been approved by EH&S within 24 months			
	Gloves are in good condition. Connectors to box are in good condition.			
	Box pressure is appropriate (negative or positive) and controlled			
	Chemical storage is limited to amount needed, properly stored			
	Box is seismically secured			
	If reactive/pyrophoric chemicals used, an EH&S assessment has been conducted			
Fire Ext.	Appropriate types, being maintained			

Other Lab Specific				
Dewers	All entrance doors posted with laser sign identifying wavelengths			
	Removable top, pressurizable dewers have top restraint system			
Working Alone	Policy has been established and everyone knows about it			
OJT Documented	There is an authorization list for potentially hazardous equipment/operations documenting OJT			

Inspection Certification

Date	Initial	Date	Initial

3. Identify, Mitigate, and Train for Hazards

Ensure that all hazards associated with your research are identified and mitigated and that all researchers and guests in your group are trained to work safely.

1. Hazard Identification

a. Review your research: identify hazards- chemical, electrical, biological, radiological, cryogens, gases, etc..
b. Update Hazard Management System [1.], and "work group" Job Hazard Analysis (JHA) [2.]
c. Generate updated signs for lab door and post them.
d. Ensure that all group members complete their JHA: **http://www.lbl.gov/ehs/jha/** upon arrival and annually
e. Discuss JHA with group member, and approve it, noting in particular the proposed additions and deletions of hazards from "work group" hazard list.
f. Confirm that researcher "accepts" approved JHA and proceeds with work AFTER completing training

2. Training

a. Notification of Required Training

The JHA lists required new or refresher training. List is on-line at **http://www.lbl.gov/ehs/jha/** or contact EH&S Administrator or Rick Kelly at x4088. Perioic reports on JHA and training status of members of your group will be provided by EH&S staff.

b. Training must be completed before research begins.

Those who have not completed training can work only under the direct supervision of trained personnel and for a ***maximum of 7 days***.

Classes can be taken on-line, before arrival: **http://www.lbl.gov/ehs/training/courses_online/index.shtml**. Some EH&S classes are available only in classroom form: **http://www.lbl.gov/ehs/training/index.shtml**. Special offerings of these classes may be arranged. Contact the Division EH&S Manager.

c. Lab-Specific "On-The-Job" Training

Use of some procedures requires on-the-job training by the PI or senior group member. Training must be documented in a log at the instrument; training must include discussion of relevant safety issues.

3. Use of Instruments in Another Investigator's (Host) Lab

User's supervisor and host PI are both responsible for ensuring that training has been completed. User first revises the JHA by entering the "work group" of the host. Host PI reports completion of training to supervisor who then approves revised JHA.

4. Campus Labs

LBNL employees, students, and guests working in campus labs must complete the JHA process as outlined above and obtain the appropriate training at LBNL or through another approved mechanism. Consult Rick Kelly.

5. Protective Equipment

Unless an exemption is requested of Rick Kelly and then approved by the EH&S Division, all work in all laboratories must be performed using at least the following personal protective equipment (PPE): *Eye protection (glasses, goggles); Clothing that covers the legs; Closed toe shoes*

Additional PPE may be required for specific work in the lab, e.g. rubber gloves when handling solvents.

6. Work Alone Policy

Each PI must establish and communicate to group members, a "working alone" policy for his/her laboratories: specify types of work which may not be performed without a "buddy" nearby and aware of the hazards. This applies to all work that may cause an injury or toxic effect that could render an individual incapable of rescuing him/herself through, for example, blinding or loss of consciousness.

(1.) Get description of the Hazard Management System from Rick Kelly.
(2.) Each researcher completes a personal JHA to identify hazards (s)he will encounter in his or her research, and training required to work safely with those hazards. PIs leading groups of researchers facing the same hazards should list those hazards in the "work group" JHA so all members of the group will see those hazards identified when they complete the JHA.

4. Authorize Work

You are responsible for authorizing work and for identifying work that requires formal authorization. Obtain and manage those authorizations.

1. **Authorization of Work:** All work in a laboratory must be explicitly authorized by the cognizant PI and only after confirming that hazards have been mitigated and participants have been fully trained.

2. **Some hazardous work requires a formal authorization document** describing how that work must be performed. It must be updated annually, when the work changes, or new staff is authorized to do it.

   Activity Hazard Document: An Activity Hazard Document (AHD) may be required for use of:

   - Class 3b or 4 lasers
   - Toxic, corrosive or pyrophoric compressed or liquefied gas (any quantity, with the exception of <27 cubic feet of CO at ambient pressure)
   - >400 cubic feet (at ambient pressure) of compressed or liquefied flammable gas
   - Reactive chemicals, (MOCVD precursors, chemicals which must be used in a glove box.)
   - Equipment that may expose users to high voltage electricity.
   - Accelerators or other equipment with unique hazards

   AHDs are created in the on-line system at: https://ehswprod.lbl.gov/AHD/login.aspx.

   X-Ray Authorization (XA): Required for x-ray diffractometers or other equipment that is designed to or capable of creating x-rays in open air. It is usually not necessary for equipment that incidentally may create x-rays, such as TEMs or very low power equipment such as XPS systems.

   Biological Use Authorization (BUA): Research activities using potentially hazardous biological materials (infectious agents, tissue culture cells, animals, recombinant DNA or RNA and material of human origin) must be reported to the Institutional Biosafety Committee (IBC): **http://www.lbl.gov/ehs/biosafety/Biosafety_Manual/html/reg__overview.shtml**

   Human Subjects Review: Required for use of any non-commercial human tissues, or personal information, when the individuals who donated the samples/information could be identified. LBNL review is required even if the work is approved at a collaborator's institution. See PUB3000 Chapter 22; **http://www.lbl.gov/ehs/pub3000/CH22.html#_Toc407001700**

   Animal Use Review: Required for all use of vertebrate animals or their tissues that are not commercially available, including primary cell lines, even if the work is approved at another institution. See: **http://www.lbl.gov/ehs/pub3000/CH22.html#_Toc407001700**

   Other Authorizations: Radiological Use Authorization, Low Activity Source Authorization.

   Contact the Division EH&S Manager before performing any work you feel might require a formal authorization.

5. Manage Chemical Use and Storage

Ensure that chemicals are used in a responsible manner by individuals trained to understand and manage their hazardous properties.

1. Labeling

- Procured containers of hazardous materials: contents, hazards (e.g. corrosive, toxic).
- Large secondary chemical containers such as squeeze bottles: contents and primary hazards.
- Small research containers, such as flasks and test tubes: some identifying marking. Hazard information generally not required.

2. Inventory

- Commercial materials with hazardous properties: you can obtain inventory datasheets from Paul Johnson and transfer to on-line "Chemical Management System" at **https://cms.lbl.gov/jsp/login.jsp**
- Apply a bar code tag to the bottle (labels from Paul Johnson).
- When container is empty, remove the bar code and remove from database.
- Chemicals used routinely in relatively large quantities: label the storage location rather than the individual bottle or bottles. Database must reflect maximum amount of chemical in storage.

3. Storage

- In a designated storage location, not in a fume hood or on a bench top
- In sealed, undamaged, labeled containers
- In secondary containment (liquids)
- Below eye level (corrosives)
- Segregated from incompatible materials, including water (water reactives)
- In the minimum quantities consistent with actual use

4. Use

Each individual who uses a hazardous chemical is expected to be familiar with:

- Its hazardous properties (toxicity, flammability, reactivity etc)
- Routes of toxic exposure
- Signs and symptoms of overexposure
- Necessary engineering, administrative and personal protective controls such as appropriate gloves, goggles, emergency eyewash system, fume hoods and first aid procedures
- Proper handling procedures, storage requirements, waste disposal requirements

5. Shipping

Potentially hazardous research materials (samples, synthesized materials, cell lines etc) that are shipped to collaborators or other persons on- or off-site must be properly packaged and labeled. In addition, a Material Safety Data Sheet (MSDS) must be shipped with the material; it may be necessary to create an MSDS if none exists. A single point of contact has been identified to assist with packaging in the Molecular Foundry; personnel from other parts of the Division should contact Rick Kelly or Paul Johnson for guidance.

6. Disposal *(see next page)*

7. Special Consideration: Peroxidizable Chemicals

Ethers, small secondary alcohols, unsaturated cyclic compounds may react to form unstable peroxides. If concentrated (e.g. distilled) they may explode. All peroxidizable chemicals must be labeled, dated when received and opened, and tested for peroxides at least annually. Some (e.g. diisopropyl ether) require testing quarterly. A test kit is available from Paul Johnson. Additional information: **http://www.lbl.gov/ehs/chsp/html/reactives.shtml** . The Chemical Management System database can be queried to identify peroxidizable solvents you are responsible for. (See schedule, page 1).

6. Manage Waste

Ensure that hazardous waste in your laboratories is properly managed.

Hazardous waste must be stored in a
Satellite Waste Accumulation Area (SAA) until disposal.

1. **Inspect your Satellite Waste Accumulation Areas quarterly.** (See schedule, page 1.) There are very specific rules that must be followed for hazardous, biohazardous, and radioactive waste. Each lab should appoint, for each SAA, a trained manager and a more junior deputy reporting directly to the PI.

   Waste may be stored in an SAA for no longer than 9 months. ***In MSD, we ask that waste be disposed of every at least every 6 months.*** Each SAA must:

   - Be on Paul Johnson's list of SAAs
   - Be posted with a completed and current SAA sign
   - Store hazardous waste only, no reagents or non-hazardous waste
   - Use approved waste storage containers, which vary with the nature of the waste
   - Be outfitted with secondary containment trays
   - Contain all the hazardous waste in the area – no hazardous waste can be stored outside of an SAA
   - Store containers labeled with a completed and dated hazardous waste label
   - Segregate incompatible waste
   - Have waste accumulation logs where wastes are bulked into a storage container
   - Segregate halogenated wastes from non-halogenated wastes
   - Be emptied regularly: waste must never be stored for more than 9 months

2. **Properly dispose of stored waste.** All SAA managers and PIs will receive an email from the MSD EH&S office every 6 months asking that they dispose of all stored waste. The disposal schedule is staggered by building so as not to overload the resources of the EH&S Waste Management Division (see Schedule on Division Safety Website).

   Every six months, perform a thorough inspection of all areas of the lab (cabinets, drawers, etc.) to locate waste containers left behind in lab moves, or after a lab member leaves. Lab members must thoroughly inspect their work areas and dispose of waste before leaving LBNL.

7. When Accidents Happen

Know what to do and whom to call when accidents happen

Become familiar with the red Emergency Response Guide hanging in each lab, describing the appropriate response to accidents.

Reporting: Report all spills and accidents immediately: call Rick Kelly x4088 during standard working hours; call EH&S x6999 after hours or if you do not reach Rick Kelly.

First Aid: Train all laboratory personnel in the use of emergency eyewashes and showers, and how to summon emergency help. First aid and CPR training is available and recommended.

Injuries: If possible, transport injured employee to LBNL Health Services (B26). If not, or after hours, call 7911 for the Fire Department paramedics. Notify Rick Kelly or Paul Johnson.

Clean-up: Some spills are too large, too hazardous or too difficult for researchers to clean up on their own. At a minimum, professional EH&S guidance is necessary, and it may be necessary to get others to perform the clean up. This includes spills:

- Involving elemental mercury
- Involving material that is air reactive
- That take two people more than an hour to clean up
- Where lab personnel are contaminated or have inhaled hazardous material
- Involving materials that are highly acutely toxic or very toxic via skin contact (e.g. phenol or dichloromethane)
- Involving >100 ml of materials containing risk group 2 pathogens
- Involving radioactive materials

Chemical Contamination: Wash off the chemical at the sink, eyewash, or emergency shower immediately. Remove contaminated clothing. If the eyewash or shower is used, call the Fire Department and Paramedics (x7911). If these are not used, use good judgment and either transport the individual to the Health Services Clinic (B26) or call 7911.

Recordkeeping: All cases reported to Health Services will require an injury report. An email will be sent to the supervisor describing the process. ***The Supervisor's Accident Analysis Report is due within 7 days of the incident***.

Fire: Call 7911 for the Fire Department. Use a fire extinguisher for very small fires, if trained to do so. Otherwise, retreat to a safe distance, alert other building occupants, and wait for the Fire Department.

Incident (non-injury, non-fire): Report "near misses" and non-injury incidents to Rick Kelly. Generally, there is no recordkeeping or sanctions associated with these events.

Comments for improving this guide: Mark Alper MDAlper@lbl.gov or Rick Kelly: RJKelly@lbl.gov